A Utility Perspective on the Deployment of CCTs Into the Next Millennium

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ABSTRACT

The successful Clean Coal Technology projects which are being discussed in this conference are all a testament to the positive advancements that can be made with environmentally superior technologies when the government and industry cooperate in the context of a properly funded and a well thought-out program. Many of the technologies developed in the Clean Coal Technology Program have taken a competitive position in the marketplace, and many others are on the verge of being competitive in the marketplace. Based on the success of the Clean Coal Technology Program, one would expect that they would be ready for full deployment in the marketplace as we approach the next millennium.

This is not happening. There are several hurdles that impede their deployment. Some of those hurdles, such as the higher first-of-a-kind cost and technology risk factors that accompany not-yet mature technologies, have existed since the initiation of the Clean Coal Technology Program. However, several new hurdles are impeding the market penetration of Clean Coal Technologies.

Those hurdles include the radically different marketplace due to the restructuring of the electric utility industry, a soft market, the difficulty in financing new power plants, low natural gas prices, and lower-cost and higher-efficiency natural gas combined cycle technology.

I. INDUSTRY RESTRUCTURING

The restructuring of the electric utility industry is being reviewed in detail at other sessions. Therefore, I will not discuss that aspect in detail here. However, at the same time, it is important to acknowledge that the restructuring of the industry from cost-based prices to market-based prices will have a great impact on the commercialization of CCTs in the domestic electric utility industry. This is because the pending change in the electric utility industry has resulted in the deferral of construction of new plants in the United States into the next decade or beyond. Until the rules of the newly restructured marketplace are known, electric utilities are not likely to add new base-load coal-fired capacity.

II. MARKET FOR NEW PLANTS

The market for new base-load, coal-fired plants in the United States is stagnant. Sales of coal-fired plants are few and far between. The load growth of electricity is lower than was projected twenty years ago when the electric utility industry was adding significant capacity to the grid. As a result, there is ample base-load capacity to serve our nation's electric system in most areas of the United States. Currently, the average capacity factor of the 720 GW of generating capacity installed in the United States is 49.6%. Most of the projected load growth for the next 10 to 15 years can be absorbed by increasing the capacity factor of existing power plants, decreasing reserve margins, and by life extension of existing capacity. It will not be met by adding base-load solid-fuel power plants.

III. FINANCING OF NEW PLANTS

In a regulated environment, utilities based decisions to erect new facilities on prudency, life cycle costs, and the regulatory compact, whereby utilities were allowed to recover the cost of prudent investments provided the facilities were used and useful, and a reliable source of electricity was provided to the ratepayers. In the deregulated environment, the key to building a new power plant is financing. One of the keys to financing is to obtain a Power Purchase Agreement. A Power Purchase Agreement is dependent on the ability of the generator to provide reliable power at competitive prices. The utility, (or GENCO or IPP or any producer of electricity by any other name) would seek a Transmission Company, Distribution Company, customer, or power broker to sign an enforceable long-term contract for the electricity produced by the new facility.

Absent a Power Purchase Agreement, the plant would be a "merchant" facility (eg. the plant is built without any assured purchaser of the power) which entails considerable financial risk. Usually, it is difficult, if not impossible to finance such a facility with project financing (using lower-cost debt to finance the project). A merchant plant would likely be financed with mostly equity (which typically is more expensive than debt).

Let's look at whether or not a Clean Coal Technology Plant could provide competitive power in today's market. Most studies which project the market price for power in the 2000 to 2005 time frame point to an average market price for energy in the range of 20 to 25 mil/kWh, and 30 to 35 mil/kWh when capacity is included in the cost. With natural gas at less than $2.00/million BTU, a Natural Gas Combined Cycle Plant can be competitive with that price level. Most new solid-fuel plants, whether a conventional or a Clean Coal Technology Plant, cannot provide power at that price. The reasons for that follow.

IV. NATURAL GAS

Since 1988, approximately 75% of new generation has been gas fired. The dominance of natural gas in recent years can be attributed to economics associated with the price differential between natural

gas and coal, the efficiency of natural gas combined cycle plants, and the decreasing capital cost of combustion turbines.

Natural gas has historically commanded a price-premium factor of 2.5 to 3 (on a BTU basis) over coal. That premium reached a low of 1.25 within the past five years, and has remained well under 2 over the past several years. It is because of this historical price premium that coal-based technologies have been competitive with natural gas technologies despite their higher capital cost. With the lower price premium, coal-based technologies tend to lose out in an economic comparison. Will natural gas prices increase in the future relative to coal prices? Current conditions do not indicate such a trend. Known natural gas supplies have increased by 30% over the last decade. The abundance of reserves, coupled with advances in extraction technologies and competition in the natural gas industry, have reduced natural gas prices by 15% in real dollars in the past five years.

At the same time, the efficiency of gas turbines has been steadily increasing. The efficiencies of the latest fleet of high-temperature gas turbines is approaching 40% for a simple-cycle configuration, and 50% for a combined-cycle configuration. The DOE projects efficiencies of 60% in advanced turbine systems by the next millennium.

Finally, the capital cost of gas turbine combined cycle plants has declined dramatically. The current cost of a Combustion Turbine Combined Cycle Plant (on a $/kW basis) is about one-half the price of a pulverized coal-fired plant.

The combination of lower fuel prices, higher efficiency and lower capital cost has resulted in lower projected life-cycle costs for NGCC Plants compared to coal-fired plants -- both conventional designs and Clean Coal Technology designs.

There are many other issues which impact the evaluation of whether or not a utility should build new generation, and what type of generation should be used. Some of them include environmental considerations, location of plant relative to the availability and cost of fuel, system stability requirements, system needs (peaking, intermediate, or base load) to name a few. There will be selected niche markets where a coal-fired plant is the economic choice. However, in the short term, I believe that natural gas will dominate new plant construction.

V. CLEAN COAL TECHNOLOGIES

Where does this leave CCTs in relation to the domestic electric utility industry? I do not believe that there will be a viable wide-scale market for solid-fuel, base-load power plants -- whether clean coal or conventional in the United States until the need for base-load power reenters the marketplace, and coal can reestablish its competitiveness compared to natural gas.

At the same time, CCTs continue to be good technologies. They have cost advantages, efficiency advantages, and environmental advantages compared to conventional technologies which must not be sold short. They have the potential to provide the higher efficiency and lower capital cost to bring

coal back to the forefront for new electric generation. But before CCTs can be competitive with natural gas, they must complete their path along technical and cost maturation curves.

In the long run, coal-based generation must continue to be a viable and important part of our nation's future generating needs. Coal is a natural resource which must not be ignored. Coal is an important aspect of our country's energy security. I believe that the dominant market for new generation in the foreseeable future will be in smaller-size generating stations. Fluidized-bed combustion boilers, especially CFBs, can continue to serve this important market niche, especially where low-grade fuels and alternate fuels (such as pet coke and biomass) are economically available. At the same time, this smaller-size market is where the competition between coal and natural gas will be the greatest. Both PFBC and IGCC technologies could be the "swing" choices for new generating facilities, which could allow coal to capture a large share of the intermediate-size power generating stations in the future.

If PFBC and IGCC can continue down their paths of commercial demonstration and cost reduction, these technologies should offer the opportunity to use coal in medium-size facilities which might otherwise be fired with natural gas. The challenge remains to continue the development of these important technologies despite the fact that the near-term market for new generation, especially coal-fired, is bleak. This is why, absent opportunities in the domestic market, it is so important to continue to focus on developing these technologies overseas.

VI. INCENTIVES

The Clean Coal Technology Program has been the model of the type of incentives that were required in the mid 1980's to assist in the commercialization of CCTs. I believe that the incentives should remain in effect to allow those projects to be completed. At the same time, it is important to acknowledge the context in which the CCT program was initiated. Natural gas prices were declining relative to coal prices, however it was expected by many analysts that would be a short-term situation. The Clean Air Act Amendments were being discussed, but were not yet enacted. Deregulation was being talked about, but it was far from a reality. The cost-sharing provided by the federal government was often tied to enhancing the cost-recovery of the project by the utility through rate consideration.

As previously discussed, conditions are significantly different now. At the same time, incentives are still required to assist the completion of the commercialization of Clean Coal Technologies. Proper incentives are still required to ensure that not-yet-mature CCTs are commercially deployed as opportunities become available. Those incentives must make these not-yet-mature CCTs cost indifferent to the customers. If the only market for CCTs is overseas, and if incentives are required to ensure that Clean Coal Technologies can be proven in this market, then it is better to pursue an international cost-sharing program than to simply claim that we should not spend CCT funds on overseas projects, and lose the momentum gained through the CCT Program.

VII. CONCLUSION

Our nation has invested a lot of effort and money in the development of Clean Coal Technologies -- in excess of $7.5 billion. Electric utilities have played a major role in that development, having been involved in a significant percentage of the Clean Coal Technology projects. This is a testimony to the importance that electric utilities place in the development of Clean Coal Technologies. Our industry and our customers cannot overlook the environmental, efficiency and economic benefits of Clean Coal Technologies. Industry and government must continue to work together to ensure that Clean Coal Technologies are ready to be used in the next fleet of power plants by being an economic choice compared to other alternatives in the future.